A RECENT EXAMPLE OF SOIL EROSION ON THE DERBYSHIRE LIMESTONE

by

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Summary

The effects of a grass-fire on the limestone crags of Treak Cliff, Castleton, in the summer of 1959 are described. Observations on soil erosion and partial recolonization by vegetation during the ensuing four years are given and their significance discussed.

Introduction

The recent International Geographic Congress in Britain had as one of its sections a karst symposium concerned with the development of limestone landscapes. Unfortunately, the papers presented will not be published by the Congress but in view of the apparent interest in the subjects of the erosion of a limestone surface and the formation of soil covers, it is hoped that this short note will be of interest. Previous work on the subject in Derbyshire is limited to that of Prentice & Morris (1959) on screes in the Manifold Valley, and of Pigott (1962) on soil profiles and composition.

The site in question is the summit ridge of Treak Cliff, one mile west of Castleton, North Derbyshire, which rises to an altitude of just over 1,300 feet above sea level. (Nat. Grid Ref:- SK 135830) The ridge has a steep easterly slope but passes rapidly on to flat ground to the west. It is formed of Carboniferous Limestone of "reef" facies, with the fore-reef slope to the east. Most of the eroded area to be described is algal reef limestone with little or no sign of bedding, and a quite irregular pattern of joints.

Observations

During the dry summer of 1959 a series of grass fires broke out, and although the major flames were extinguished by beating, smouldering continued for a week afterwards. As a result of this an area along the

summit ridge, roughly estimated as 250 yards long and up to 100 yards wide, mostly on the easterly slope was denuded of all its vegetation, leaving only ash and bare soil, here a rendzina (a friable loamy soil with grains of the parent limestone in it),rarely more than six inches thick and generally much less. Following the frosts of the subsequent winter, there was a succession of easterly gales and these effectively removed, not only the ash, but also the greater part of the soil. This left an area of bare limestone, roughly estimated as between 5,000 and 10,000 square yards, where previously only small crags had projected through the turf, thus radically altering the appearance of the hill from the valley below.

In the four years since this stripping, observations have been made at intervals to see whether the soil and vegetation cover is being re-established, or whether the area of erosion is increasing. Up to the summer of 1963 it appeared that the area of erosion was slowly increasing in places, and also the newly bared limestone was suffering erosion. The processes appeared to be as follows: wherever soil patches remained in hollows a few inches deep and across, these were recolonized by scattered annual plants and a little grass, but during subsequent gales the soil again dried out, and on several occasions whole plants together with their clumps of turf were also seen to be torn off the margins of unburnt soil. This process has been augmented by sheep scrambling across and around the burnt area and loosening both soil and turf. The limestone itself, having been bared, provided a new surface for the attack of rain and frost, and much of it was very loose by the summer of 1963, and boulders had rolled down the hill to form the potential beginnings of a scree slope. This has again been assisted by sheep, and by geologists digging for fossils in the newly exposed rock! Up to the summer of 1963 the only definite recolonization was in a few more sheltered and damper places, where mosses and lichens had taken root.

Since the summer of 1963, considerable changes have taken place. The wet summer, the lack of easterly gales and the marked lack of frost (up to the time of writing in March, 1964), have together allowed much more extensive recolonization, and except for the most exposed places and the newly formed screes, moss now fills every joint, and the surface is very much more stable. Seedlings of several annuals have taken root in the moss and a few tufts of bent grass, sheep fescue and stone crop have become established. It remains to be seen whether these will survive the next gales, though the general impression is that they will do so over at least some of the area.

It thus seems that the fate of this burnt area is still in the balance. Taken to a logical conclusion, if the next gales again remove the vegetation, the ultimate effect of these grass fires will be to allow both chemical and physical erosion of the limestone downwards until a stable slope is established, with the accumulation below of a scree slope overlying the turf and soil lower down the hill. In a fossil soil profile this change would probably have been taken to indicate a climatic change! On the other hand, if the vegetation cover remains stable and gradually covers the area, little will be left as evidence of the grass fires, except the beginnings of scree lower down the hill being slowly buried in the grass, plus a more humic soil over the burnt area, with at least for a time a plant association dominated by annuals.

How the fires started in this case is not known, but it was probably the common effect of broken glass focussing the sun's rays. If so, the erosion may be ascribed to the hand of man, even if unintentional. An alternative natural cause is lightning which, whilst not observed in the case described above, has at other times been seen to strike the ground on Treak Cliff and to scorch the turf over a yard diameter patch. Several other grass fires took place on the gritstone country during 1959, and whilst there was some wind erosion of the peat thus exposed, the much greater depth of soil precluded complete baring of the rock and provided more favourable conditions for plant recolonization.

Conclusions

In conclusion one can only speculate how many accidental grass fires have resulted in the baring of limestone surfaces in the past, not only in Derbyshire, but also in the Ingleborough region and possibly in

Fig. 1. Treak Cliff before the grass fires of 1959. Note that the summit ridge of Treak Cliff (on left) shows little exposed limestone. (Photo by permission of H. Harrison)

Fig. 2. Treak Cliff after the grass fires of 1959. Note the white area of exposed limestone along the summit ridge.

Fig. 3. The newly exposed limestone surface photographed in 1963. The whole of this area was covered with turf before the grass fires of 1959, but is now bare rock or loose scree.

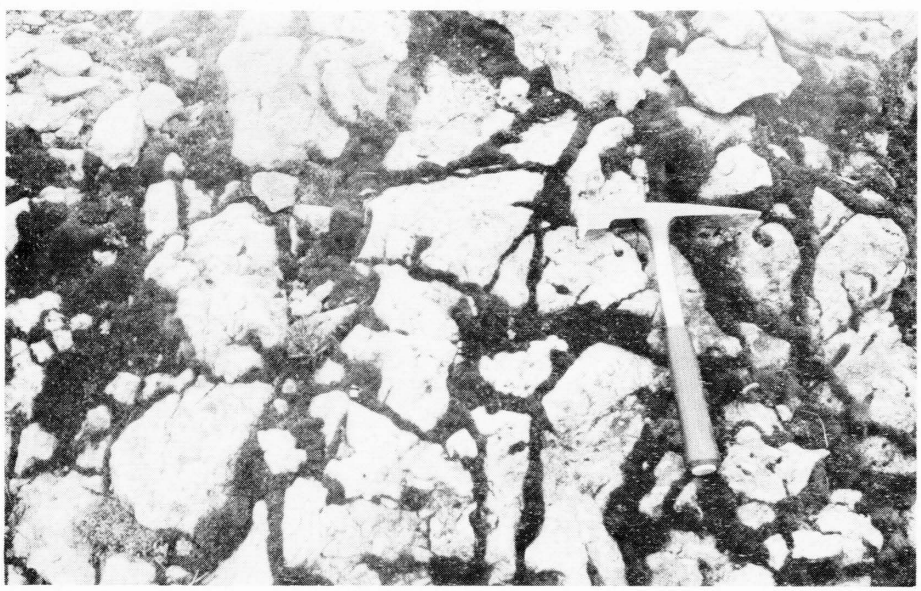

Fig. 4. Recolonization of part of the exposed surface by moss as seen in March 1964.

the Mediterranean countries,where the climatic changes and overgrazing have often been held responsible for the erosion of the former soil cover on the bare limestone hills so prevalent today.

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